

Melanism in European plethodontid salamanders

(Amphibia, Plethodontidae, *Hydromantes*)

Enrico Lunghi, Gentile Francesco Ficetola, Benedetta Barzaghi,
Chiara Vitillo, Manuela Mulargia & Raoul Manenti

Lunghi, E., Ficetola, G. F., Barzaghi, B., Vitillo, C., Mulargia, M. & Manenti, R. 2017. Melanism in European plethodontid salamanders (Amphibia, Plethodontidae, *Hydromantes*). *Spixiana* 40 (1): 157–160.

Melanism represents a well-known chromatic aberration within reptiles, but very few information is available on amphibians. During five years of field surveys we observed more than 3000 individuals of European cave salamanders (genus *Hydromantes*), five of which showed melanistic pattern. Our observations report the first cases of melanism for European cave salamanders.

Enrico Lunghi (corresponding author), Universität Trier, Fachbereich VI Raum- und Umweltwissenschaften, Biogeographie, Campus I, Gebäude N, Universitätsring 15, 54286 Trier, Germany; Museo di Storia Naturale dell'Università di Firenze, Sezione di Zoologia "La Specola", Via Romana 17, 50125 Firenze, Italy; Natural Oasis, Via di Galceti 141, 59100 Prato, Italy; e-mail: enrico.arti@gmail.com

Gentile Francesco Ficetola, Benedetta Barzaghi & Raoul Manenti, Dipartimento di Bioscienze, Università degli Studi di Milano, Via Celoria 26, 20133 Milano, Italy

Gentile Francesco Ficetola, Laboratoire d'Ecologie Alpine (LECA), CNRS UMR 5553, Université Joseph Fourier, BP 53, 38041 Grenoble Cedex 9, France; CNRS, LECA, 38000 Grenoble, France

Chiara Vitillo, Via dello Sbirro 30, Roselle (Gr), Italy

Manuela Mulargia, Via Isalle 4, 08029 Siniscola, Italy

Introduction

Abnormal or uncommon patterns of pigmentation have been reported in herpetological literature since its beginnings and are yet of great interest for zoologists and keepers. Chromatic abnormalities are well known within amphibian species (Hoffman & Blouin 2000, Rivera et al. 2001). The most usually reported abnormalities involve the reduction (total or partial) of chromatophores: this is the case of albinism and leucism (Dyrkacz 1981). In this circumstance, individuals show white/pale coloration and these traits may determine a low viability (Toledo et al. 2011). On the other hand, cases in which pigmented cells are more abundant than in normal individuals (axanthism and melanism) are less often described within

amphibians (Jablonski et al. 2014). In fact, besides the salamander species that are naturally melanistic (e.g. Lanza's alpine salamanders, *Salamandra lanzai* and alpine salamander *S. atra* in Europe) only few cases of dark coloration are reported in literature and mainly deal with anuran species (Alho et al. 2010, Riobo et al. 1999). To our knowledge, cases of melanism in salamandrid species concern just four taxa: *S. salamandra*, *Triturus marmoratus*, *Euproctus asper* and *E. montanus* (Manenti 2006, Rivera et al. 2001). Contrary to albinism and leucism, an increase of dark pigmented cells might even be advantageous, for instance because melanistic individuals may gain heat more quickly, and thus spend less time basking and reduce exposition to predatory risk (Clusella Trullas et al. 2007, Vences et al. 2002).



Fig. 1. **A.** Melanistic juvenile of *Hydromantes imperialis* found during early summer of 2014. **B.** Melanistic juvenile of *H. flavus* found in spring 2016.

Results

Here we report the first observations of melanism in European plethodontids (genus *Hydromantes*; see Wake 2013 for further explanation on taxonomy). During 2012–2016, we investigated populations of the eight species of European *Hydromantes*, and observed more than 3000 individuals: (*H. strinatii*: 164, *H. ambrosii*: 593, *H. italicus*: 546, *H. flavus*: 302, *H. supramontis*: 392, *H. imperialis*: 900, *H. sarrabusensis*: 103 and *H. genei*: 275). We detected a total of five melanistic individuals in three of the eight species: *Hydromantes flavus* (3), *H. imperialis* (1) and

H. ambrosii bianchii (1). In 2014 we found one melanistic juvenile *H. imperialis* (total length: 3 cm) in a cave located in Ogliastra district (Eastern Sardinia, Lat. 39.85° Lon. 9.46°) (Fig. 1A) and one melanistic adult female of *H. a. bianchii* (total length: 11 cm) in the La Spezia district (Eastern Liguria, Lat. 44.08° Lon. 10.02°) (Fig. 2A). In two occasions (2015 and 2016) we found melanistic *H. flavus* in a cave located in Nuoro district (North-eastern Sardinia, Lat. 40.46° Lon. 9.52°): the first individual was a female (total length: 12 cm; Fig. 2C); the second one was a juvenile (total length: 7.5 cm, Fig. 1B). Finally, in another cave of the Nuoro district (Lat. 40.51° Lon.

9.61°), in 2015 we found one adult melanistic male with total length of 11 cm (Fig. 2B). All melanistic salamanders showed a dark pigmentation covering most of upper part of their body. In *H. flavus* adults (Fig. 2B–C), both limbs and flanks showed a more pale dark coloration, as normally these body parts are lighter or totally depigmented (Lanza et al. 2006).

Even if extensive studies have been performed on European plethodontids, no mention to melanistic individuals were reported (Lanza et al. 1995, 2006). In fact these species normally have a cryptic habitus, avoiding direct exposure to the sun and becoming thermally conform with exploited environment (Lunghi et al. 2016). Our findings indicate that melanism represents a quite rare condition in *Hydromantes* salamanders, but that can be observed both in juveniles and adults.

Our study provides the first observations of melanistic patterns occurred in European plethodontids.

Acknowledgements

E. Lunghi is supported by The Mohamed bin Zayed Species Conservation Fund, The National Speleological Society and Instrumentl. The study was conducted under Italian Ministerial Authorization (Ministry of the Environment, 9384/PNM of 12/05/2015).

References

Alho, J. S., Herczeg, G., Söderman, F., Laurila, A., Jönsson, K. I. & Merilä J. 2010. Increasing melanism along a latitudinal gradient in a widespread amphibian: local adaptation, ontogenic or environmental plasticity? *BMC Evolutionary Biology* 10: 317.

Clusella Trullas, S., van Wyk, J. H. & Spotila, J. R. 2007. Thermal melanism in ectotherms. *Journal of Thermal Biology* 32: 235–245. doi:10.1016/j.jtherbio.2007.01.013

Dyrkacz, S. 1981. Recent instances of albinism in North American amphibians and reptiles. *Herpetological circular* 11: 1–31.

Hoffman, E. A. & Blouin, M. S. 2000. A review of colour and pattern polymorphisms in anurans. *Biological Journal of the Linnean Society* 70: 633–665.

Jablonski, D., Alena, A., Vlček, P. & Jandzik, D. 2014. Axanthism in amphibians: a review and the first record in the widespread toad of the *Bufo* complex (Anura: Bufonidae). *Belgian Journal of Zoology* 144: 93–101.

Lanza, B., Caputo, V., Nascetti, G. & Bullini, L. 1995. Morphologic and genetic studies of the European plethodontid salamanders: taxonomic inferences (genus *Hydromantes*). *Monografie del Museo Regionale di Scienze Naturali, Torino* 16: 1–366.

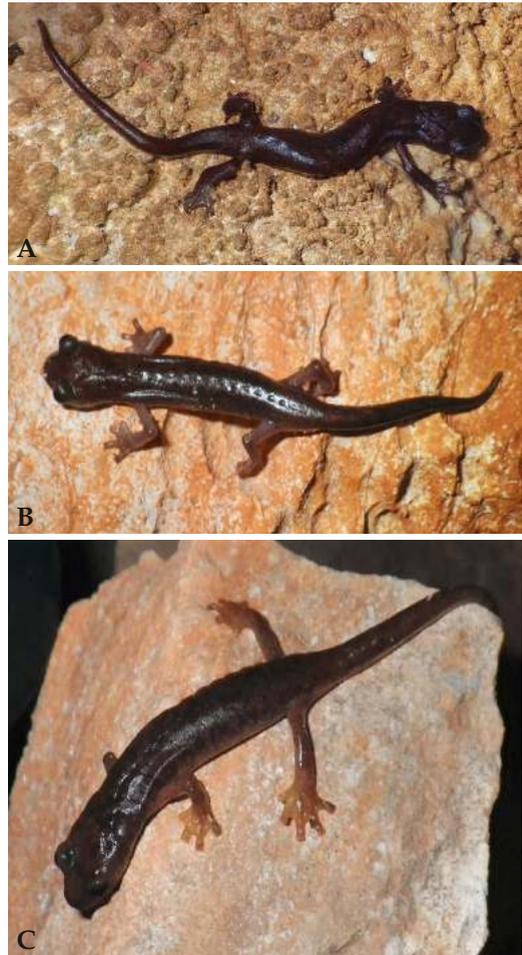


Fig. 2. Three melanistic adults of *Hydromantes*: **A.** *H. ambrosii* found in summer 2014; **B.** a female and **C.** a male of *H. flavus* found in autumn 2015.

—, Pastorelli, C., Laghi, P. & Cimmaruta, R. 2006. A review of systematics, taxonomy, genetics, biogeography and natural history of the genus *Speleomantes* Dubois, 1984 (Amphibia Caudata Plethodontidae). *Atti del Museo Civico di Storia Naturale di Trieste* 52: 5–135.

Lunghi, E., Manenti, R., Canciani, G., Scari, G., Pennati, R. & Ficetola, G. F. 2016. Thermal equilibrium and temperature differences among body regions in European plethodontid salamanders. *Journal of Thermal Biology* 60: 79–85. doi:10.1016/j.jtherbio.2016.06.010

Manenti, R. 2006. Un cas de mélanisme chez *Euproctus montanus* (Savi, 1838). *Bulletin de la Société Herpétologique de France* 117: 65–66.

- Riobo, A., Rey, J., Puente, M., Miramontes, C. & Vences, M. 1999. Ontogenetic increase of black dorsal pattern in *Rana temporaria*. British Herpetological Society Bulletin 70: 1-6.
- Rivera, X., Arribas, O. & Martí, F. 2001. Revisión de anomalías pigmentarias en los anfibios de la Península Ibérica y de Europa. Butlletí de la Societat Catalana d'Herpetologia 15: 59-75.
- Toledo, L. F., da Silva, N. R. & dos Santos Araújo, O. G. 2011. Albinism in two Amazonian frogs: *Elachistocleis carvalhoi* (Microhylidae) and *Lithobates palmipes* (Ranidae). Herpetology Notes 4: 145-146.
- Vences, M., Galán, P., Vieites, D. R., Puente, M., Oetter, K. & Wanke, S. 2002. Field body temperatures and heating rates in a montane frog population: the importance of black dorsal pattern for thermoregulation. Annales Zoologici Fennici 39: 209-220.
- Wake, D. B. 2013. The enigmatic history of the European, Asian and American plethodontid salamanders. Amphibia-Reptilia 34: 323-336.